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SPACE EXPLORATION AND EXPLOITATION

by
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I must say at the outset that Governor Hatfield's invitation to be here today was a welcome one. It has been many years since I have been privileged to live and travel in the Pacific Northwest. As a youngster fresh out of college--fresh in many ways--I lived in Seattle for a year and there found two of those five proverbial lifelong friends one speaks of as the limit to which real and significant friendships usually extend. For most of that year, I spent one day each week in this beautiful City of Roses. I was working as an engineer in the then exciting new industry--the talking motion pictures. My haunt in Portland was a theatre known as Hamrick's Blue Mouse which many of you may well remember. As I look back, I can truthfully say--those were the good old days!

Now I find myself in another exciting new business--the business of space exploration and exploitation for the benefit of all mankind.

And it is about that business that I want to speak to you today. This morning you had revealed to you the wide-ranging interests of the military services as they work ceaselessly and effectively to maintain a strong defensive shield for this nation and the Free World. At the same time, they are providing the real deterrent to war--the ability to retaliate effectively and in a truly devastating manner should this nation ever be the object of an attack by those who talk peace but actually block every avenue of approach to real peace. I am proud to be on the same program with Admiral Bennett, General Schriever and General Ely.

Having had this break for lunch perhaps you will now shift gears with me as I describe for you the brief history of NASA and the dimensions of the program of space exploration on which we are engaged. I would like to tell you something of the philosophy under which we have developed our plans and under which we now operate. A recounting of the major elements of our program will then bring me to my conclusion--a discussion of the use of satellites for long distance communications and an identification of certain issues of public policy that undoubtedly will arise in this field.

The real space age began just three years ago when the Soviet Union launched into an earth orbit the world's first artificial satellite--Sputnik I. Most of you will remember the consternation and confusion that accompanied that announcement in this country. A sense of hurt pride--even shame--was evident on all sides. We had been found wanting in a competition in which we hadn't even entered.

A few short months later--on April 2, 1958--President Eisenhower proposed to the Congress the establishment of a civilian agency

to conduct research and development in the fields of aeronautics and space. After considerable and spirited debate, the Congress passed and the President signed the National Aeronautics and Space Act of 1958 establishing the civilian agency--NASA--and reserving space activities peculiar to or primarily associated with weapons systems or military operations to the Department of Defense. On August 19th my deputy Dr. Hugh Dryden and I were sworn in and began the operation which we declared to be ready for business forty days later--on October 1st, 1958. Today--2 years and 12 days later--NASA is a young, but rapidly maturing organization determined to carry out a first rate research and development program in this newest and most exciting field of scientific and technological endeavor in this country.

These two years have seen startling increases in the allocation of manpower and other resources to this activity. The law provided that we absorb the National Advisory Committee for Aeronautics--the NACA--for more than forty years the world's most distinguished aeronautical research organization. As a result of this action, we acquired 8000 well seasoned employees, three large research establishments and two field stations--and with these assets we built the basic structure of our present organization. Today, we have almost 19,000 employees, the bulk of the additional 11,000 having come to us by transfer from the Army of the Jet Propulsion Laboratory in Pasadena, California, and the von Braun team at Huntsville, Alabama. Actually, somewhat less than 2000 people have been added by NASA to the Federal payroll in this period of rapid growth. Only one new laboratory is being built--the Goddard Space Flight Center at Greenbelt, Maryland--where we will have, eventually, a 2400 man staff.

As to money--it should be noted that we operated in Fiscal Year 1959 at a 335 million dollar annual rate. Congressional appropriations totalled 524 millions in Fiscal Year 1960 and for the year ending next June 30, we are operating at a level of 915 million dollars. Except for wartime or defense-induced emergencies, I doubt that any other organization has grown at such a rate.

Now let me turn my attention to a discussion of the basic philosophy under which we have developed our program over the past two years. It is necessary that you understand that we are a research and development organization. We are not an operating organization in the ordinary sense of that term. We don't make bombs or missiles or aircraft. We don't expect to operate meteorological or communications systems. Our product is knowledge--new and fundamental knowledge--and the techniques, processes, devices and systems by means of which we acquire that knowledge. The rocket powered launch vehicles we design and buy are not an end in themselves--they are the cargo carrying trucks of space, discarded when their fuel is exhausted.

Our program development has proceeded under five basic assumptions:

First, it must be a soundly conceived program for the long pull. This meant the exploration of a wide range of phenomena in outer space, the understanding of which would enable us to design larger and more complicated spacecraft for more advanced instrumented missions and ultimately, to make manned flight in space a reality. Lacking rocket-powered launch vehicles of high-thrust capability, we have been limited, thus far, to light-weight payloads. What seemed, initially, a real impediment to progress was turned, however, into a virtue as we began

to fly satellite and deep-space missions using very much miniaturized components. Thus began the exploration of radiation, gravitational, and magnetic fields, of the incidence and hazards of micrometeorite impacts, of temperatures, pressures and the nature of the vacuum of outer space. From these flights we have learned much about the space environment and about the technology involved in both manned and unmanned space exploration.

Second, we proposed to push the program as fast as the developing technology would permit without resorting to the so-called "crash" approach. By and large, we have been given the needed resources to do this.

Third, we decided to avoid adding large numbers of people to the Federal payroll. Our intention was and is to utilize industrial and educational and other nonprofit institutions to accomplish the major part of our task. More than 75 per cent of our budget is spent with industry while we retain "in-house" only enough research and project activity to enable our people to work at the forefront of the field and thus to be able to manage effectively the technical efforts of our contractors.

Fourth, we were determined and are determined to avoid wasteful duplication, either between our own research and development centers or between NASA and the military services. In this effort, we have been reasonably successful, although it requires constant vigilance to be assured that such duplication does not appear.

Finally, we made up our minds to resist efforts, from whatever quarter, to undertake projects designed principally for propaganda purposes. We are aware of the nature of the competition we are in

with the Soviet Union and surely we recognize the effective propaganda efforts they have used against us in connection with the spectacular and worth-while achievements in their own space program. Lacking any real knowledge of the nature and content of the Soviet program and limited in the thrust of our own launch vehicle systems, we decided that a properly structured, broadly based and urgently prosecuted program would turn up, in its own time, some exciting and dramatically spectacular results. In this, we have not been disappointed, and it does appear that the people in our own country and in the rest of the world have regained much of their respect for and their confidence in the scientific and technological capability and leadership of the United States.

The research and development program which rests on these five assumptions is intended to satisfy a number of objectives stated in the Space Act of 1958. Among them we find--

--the expansion of human knowledge of phenomena in the atmosphere and in space;

--the establishment of long-range studies of the potential benefits to be gained from such activities utilizing the space environment;

--the exchange of information and results with the military departments in the interest of improving the defensive potential of the nation;

--the development of cooperation by the United States with other nations active in this work and in the peaceful applications thereof; and

--the preservation of the role of the United States as a leader in this field and in the application of this new technology to the conduct of peaceful activities of a nature beneficial to all mankind.

The major elements of the broadly based and wide-ranging program we have under way can be divided into three categories--(1) scientific investigations in space, including the exploration of the moon and the nearby planets; (2) the development of useful applications of the phenomenology of outer space in fields such as in meteorology and communications; and (3) the flight through outer space of manned vehicles for research and exploratory purposes.

Underlying these program elements are the development of spacecraft carrying instrumentation and other apparatus required to accomplish the desired mission objective; the engineering development and production of rocket-powered launch vehicle systems that are needed to propel unmanned and manned spacecraft into orbit or deep space; and the construction of tracking and data acquisition stations necessary to evaluate the immediate success of the launch and to acquire and reduce for analysis the millions of bits of information about the phenomena we are investigating.

The search for new knowledge through investigation of the space environment involves most of the important scientific and engineering disciplines as well as many of the professions. The astronomer eagerly awaits an opportunity to mount his telescopes on platforms above the earth's atmosphere, confident that new worlds await him as his ability to penetrate the distant reaches of the galaxies are thus enhanced. The physicist and the chemist will conduct experiments intended to probe into the earth-sun relationship and to open new avenues in the study of the origin of the earth and our solar system. The life scientist is excited about the possibilities of discovering forms of

extraterrestrial life and of deepening his understandings of the origin and nature of the life process. The mathematician, the metallurgist, the lawyer, the medical man, the political scientist--indeed, almost every category of specialized talent--finds in this program a new and exciting challenge to his creative instincts and natural curiosity.

That there will be tangible benefits for mankind from our space program appears certain. In the field of weather forecasting, the success of our first, relatively crude, experimental meteorological satellite, Tiros I, in observing and recording, from a vantage point 400 miles above the earth's surface, the phenomenology of weather formation, suggests that improved weather forecasting techniques will be possible. Longer range and somewhat more accurate forecasts of weather conditions in almost any part of the earth on a timely basis could result in very substantial benefits to mankind.

Similarly, the probability of successful and economically feasible use of satellite-based mechanisms for the transmission of various types of communications over long distances is sufficiently encouraging as to cause the nation's great communications organizations to consider seriously the undertaking of a substantial expenditure from their own corporate funds for the development of such systems.

Let me conclude now with a more detailed but brief discussion of the prospects for and the problems to be encountered in the development of a communications satellite system for commercially useful purposes.

This subject should be of special interest here in Oregon. Today, 15 per cent of the world's international telegraph traffic is to and from the Pacific area. Between 1950 and 1959, the Pacific area accounted for 30 per cent of the world's international telephone

traffic and 36 per cent of the revenue. Moreover, the vast distances involved in trans-Pacific communications make the use of satellites relatively attractive as a substitute for and a supplement to expensive submarine cables and a sometimes unreliable ionosphere.

With regard to communication satellites, you might well ask where do we stand, as a nation, where are we going, and what route should we follow?

The brief answer to these questions is this: We are currently engaged in the early stages of research and development in this area. We are anticipating a time--not too many years from today--when satellites will provide new and reliable links in commercial long-distance, trans-oceanic telephonic and telegraphic communications as well as new means for intercontinental radio and television services.

Before outlining what NASA proposes to do, let me put this promise of things to come in a proper perspective.

There is, first of all, a substantial amount of research and development to be done. The success of the first Echo passive reflector satellite and the more recent and equally successful launching and operation of an active repeater satellite--Courier--by the Department of Defense are very encouraging first efforts. But, in my opinion, we are several years from the inauguration of reliable satellite communications services.

Secondly, the most useful application of satellites for long-distance communications--that of spanning the oceans--will involve other countries. This will call for the development of a sound international policy upon which to erect the operational systems.

Thirdly, the utilization of satellites to provide communication

links as a part of ordinary commercial services may involve, in the not too distant future, the first non-governmental activity in outer space. Traditionally, communications services in this country have been provided by privately-financed carriers competing with one another to serve the public interest under Federal controls and regulations. There seems to be no reason to change that policy with the advent of communications satellites. It is clear, however, that such activities involving the launching of vehicles into outer space must be regulated in the public interest, even during the stages of developmental testing.

Finally, I might observe that the objective of the whole effort is characteristically American. It involves applying the knowledge of science and technology to every-day human needs. As set forth in the Space Act, it involves an application "to peaceful purposes for the benefit of all mankind."

Needless to say, the promise of things-to-come is not an easy one to realize. Problems of component life, problems of launch vehicle and spacecraft engineering, problems of discovering the types of satellites best suited for the services in demand, problems of system reliability, problems of economics, and problems of international arrangements, lie before us. We must know more than we do if we are to avoid, at some time in the future, the long-distance operator saying, "I'm sorry you were cut off, sir, but your satellite just went out of range."

NASA has a statutory duty to preserve the leadership of the United States in space technology and in the application of it to the conduct of peaceful activities. What, therefore, does NASA propose to do?

NASA is formulating and will carry out a research and development program which will endeavor to accelerate the nation's progress toward this practical application. While continuing with its development program using the passive reflector type communications satellite of which the Echo balloon is the first experiment, NASA is programming an early demonstration of the technical feasibility of very light-weight active-repeater satellites placed in an orbit 3000 to 5600 miles above the surface of the earth. NASA will explore with the aid of industrial contractors the main technological approaches which do not over-lap with military undertakings where security of communications is of paramount importance and which do not duplicate private industrial developments which are aimed at commercial operations.

In addition, NASA's support will be given to technically promising private proposals on a cost-reimbursable basis. This means that NASA will, to the extent of its statutory authority, make vehicles, launching and tracking facilities and technical services available at cost to private companies, provided the private plans for the development and commercial utilization of communication satellites are technically promising and in general consonance with the requirements of other licensing bodies.

The guide lines that we are following are these: NASA's efforts to realize the promise of space technology in the communication satellite field will be accelerated but they will not be conceived as a "crash" program, nor will they duplicate well conceived activities of the military or the commercial projects of private companies. NASA's efforts will proceed technically along a sufficiently broad front to

assure the objective of achieving a system capable of practical application. Finally, NASA will continue its research and development efforts in this field only so long as is necessary to assure that timely development of a commercially feasible communications system will be completed by private industry.

Gentlemen, in these few minutes I have attempted to give you a composite and highly condensed picture of the origin and dimensions of the NASA organization, its philosophy of program development and the sketchiest of program descriptions. Finally, I have attempted to spell out our approach in one area holding a bright promise for early, effective and beneficial use in the satellite field--that of the communications satellite. Working in partnership with participating industries, we have high hopes of an early demonstration of an economically sound application of space technology in the augmentation of existing but soon to be overloaded communications facilities.

Once again, we are seeing the accelerating pace of scientific and technological advance in this country move rapidly toward results that will become important to mankind as part of his everyday life. It is a rewarding experience to be privileged to participate in this effort. And it has been a rewarding experience to have the privilege of speaking to you today.

Thank you.